JCOM

UNIVERSITIES AND SCIENCE COMMUNICATION

Universities as living labs for science communication

Caroline Wehrmann and Maarten C. A. van der Sanden

Abstract

Science communication research and education programmes worldwide exhibit notable differences as well as similarities. In this essay the authors claim that this diversity is not a problem. They argue that universities can contribute well to the science communication field, theoretically and in practice, if they invest in building collaborations and make use of the 'networked pattern' connecting various actors, contexts and contents. As critical nodes in the networks, universities can enable practitioners to deliver real-life cases, students to participate to find solutions and researchers to investigate and explain. Universities can also prepare their students and (future) practitioners for lifelong learning in the dynamic context of science communication, helping them to become adaptive experts. These two aspects will be illustrated in the case study of Delft University of Technology in the Netherlands.

Keywords

Professionalism, professional development and training in science communication; Science communication: theory and models

Introduction

Science communication is more and more seen as a continuum of interactions amongst researchers, practitioners and business developers, policy-makers and citizens [see e.g. Davies and Horst, 2016; van der Sanden and Flipse, 2015]. Within this continuum science communication units or centres at universities all seem to take their own focus and perspective ranging from a more deterministic focus on e.g. practices of science communication, public engagement or science museums, to a more holistic perspective e.g. on processes of innovation, institutionalisation and politicisation [Trench and Bucchi, 2010; Broks, 2017; van der Sanden, Evans and Priest, 2017]. This is also reflected in the diversity of science communication education programmes throughout the world [Hong and Wehrmann, 2010], where there are differences in student backgrounds, in the focus, in the research methods learnt and deployed, and in learning aims. An inventory of PhD-research in science communication since 2000 [van der Sanden et al., 2016] displays its steady growth and international spread but also the variety of research themes, scientific and technological contexts and supervision structures.

This diversity in research and education programmes seems to give us little guidance in the further development of the science communication field. In our view, however, diversity does not have to be a problem for developing the domain. Universities can contribute to the science communication field if they invest in building collaborations and make use of the 'networked pattern' connecting various actors, contexts and contents along the science communication continuum. As critical nodes in these networks, universities can invite practitioners to present real-life cases as part of their education, deliver teams of students to find new approaches and solutions and use these settings to do research. In this way they contribute both theoretically and in practice to the science communication field. Another way for universities to contribute to the development of the field is to prepare students and practitioners for lifelong learning in this dynamic context. After all, science communication practice is continually changing. Practitioners frequently face new problems and have to find effective solutions and develop new procedures.

In this context, practitioners need a good understanding of practice and reliable routines. They must be able to innovate, or in other words, they have to be adaptive experts. Developing adaptive expertise is a process of years, so science communication students and practitioners should be prepared for lifelong learning. In fact, building routine and innovating are contradictory processes. Building routine is a process in which problems are reduced to tasks that can be put in practice efficiently. Innovation, on the other hand, asks for progressive problem reduction: an iterative process in which insights are combined and applied to understand and solve more and more complex problems [Hatano and Inagaki, 1986; Schwartz, Bransford and Sears, 2005]. The challenge for practitioners is to find the optimum between both processes, not only to function well personally, but also to contribute to the development of the science communication field. After all, if they can deal with uncertainties and dynamics in everyday practice, they can better articulate their added value as science communicators and the questions that could be addressed in science communication research.

Development of the science communication field

In their contribution to a previous commentary in this journal Trench and Bucchi [2010] state that two dimensions should be considered to determine the status of science communication as a discipline: the clarity with which the field is defined and the level of development of theories to guide formal studies. They conclude that science communication will benefit more from a clear articulation and deeper exploration of its relations with neighbouring fields such as science and technology studies, science education and health communication, than from further insistence on its separateness and uniqueness. From the examples of diversity given above we learn that currently neither a clearly defined field of science communication research and practice nor a defined level of theoretical development is within our reach to guide further studies.

So, what possibilities do we have to develop the science communication field? In our view, we could make use of the theoretical, educational and practical diversity to show the 'tensions', as Trench refers to in his contribution to this JCOM Commentary, researchers and practitioners can learn from. From a systems theory perspective we might say that identifying boundaries between science communication research fields, between science communication practices and amongst research and practice is a starting point for bridging those boundaries. If we see science communication as a continuum of interactions between all sorts of actors in science and technology development, we might overcome our own deficit and value diversity, and therefore learn from each other by being different and engaged with each other.

A critical comparison between the different topics and modes of research in science communication may demonstrate how several levels and various approaches of science communication are connected in a comprehensive way. This is possible if we see science communication as a networked field of practice and research in the context of science and technology development. Searching for similarities and differences in science communication approaches from this theoretical meta-perspective is a suitable strategy to understand the system's characteristics and its dynamics. On the meso-level, comparing various angles to a problem, for instance in multidisciplinary research on self-driving cars, could lead to reformulation of the communication problem, exploring future communication options or possible implementations.

Universities can play an active role in inviting researchers, policy makers and business developers from research consortia to the research and intervention table of the university's science communication department, to identify and discuss the boundaries, and to use the theories and experience of all actors involved to find solutions. Students can be involved in this process as well. In this way the science communication department becomes a research, support and advice node in the network that connects at the meta-, meso- and micro-levels of social interaction. Theoretical and practical science communication research outcomes can be returned immediately to these collaborative networks.

Network node

At Delft University of Technology the science communication department functions as such a network node by being part of a team of researchers and developers of high-tech innovations and inviting practitioners and researchers into the communication laboratories. In one of the courses of the Delft MSc programme in science communication, called C-lab, students, teachers and professionals collaborate to deal with complex communication issues in technical innovation processes. Technical innovations are complex issues with many uncertainties, so-called 'ill-defined wicked problems'. Characteristic of these kinds of issues is that nobody has an overall picture of the entire problem and often there are spontaneous events that could not have been foreseen. A step that takes a short time from the technical point of view can easily give rise to resistance among the parties involved; the technical reality usually does not coincide with the social reality of the project. The development of communication processes to support or supervise these technical processes is therefore complex as well. Designing is a means to find a solution to this type of problem systematically. That is why designing is a main aspect in our education programme. Within the course, students are working in multidisciplinary teams of four or five persons, all from different technological disciplines. They work towards a concrete communication solution, ranging from a communication strategy to a tool to support science communication professionals taking decisions. In this process they combine theoretical knowledge and experience, creativity and intuition in an explicit and structured way. The student teams work together for an entire semester with the commissioners of the project.

Within this C-lab approach students have time to search for relevant communication theories and to explore design options that most of the practitioners lack. The practitioners have the routine and years of experience. The collaboration leads to new insights for all parties involved and to useful tools for communication. It prevents communication from being deployed routinely. Another advantage is that there is an optimal connection between the technological innovation process and the science communication process. A typical case in C-Lab is about setting up an effective collaboration between 18 professors in medicine and engineering from two different universities and a medical centre. The students questioned and researched the multidisciplinary network and developed a game that structures items for the consortium board meetings.

Adaptive expertise

As mentioned above, a second contribution universities can make is to prepare students and practitioners for lifelong learning as adaptive experts in the dynamic context of science and technology. Science communication practitioners have to deal with many parties and varying interests. In order to deliver added value, science communication practitioners must look for solutions that fit the new setting and that are coherent and, especially, effective. They have to be flexible, able to switch quickly and see new solutions. Many practitioners in science and technology have built up strong routines and sets of problem-solving skills through many years of practical experience and passion, enabling them to quickly recognise and analyse situations and generate solutions. They have developed a good feeling about what works. Experience, knowledge and intuition contribute to this. But it takes more to come up with solutions or approaches for new problems. To be able to innovate, it is important to be curious and persistent, reflect on what you as a practitioner can contribute to the solution, but realise how little you know compared with all that is known. The innovative practitioner needs to be able to appoint uncertainties, and to work towards continuous improvement and development [Wehrmann and Henze-Rietveld, 2016]. Appoint uncertainties is about the capability of recognise uncertainty as something inevitable, because there will always be uncertainty, but you need to deal with instead. Someone, who is able to do this, is no longer obstructed by uncertainty, but is able to make it more explicit, tangible, discussable and learns from it. That means working through contradictory processes: routine requires reducing problems to tasks that can be performed efficiently; innovation calls for progressive problem-solving, an iterative process in which new insights are combined and applied to understand and solve increasingly challenging problems. If a practitioner manages to develop and unite both types of expertise, they may be considered an adaptive expert. The challenge lies in the search for the optimum of innovation and routine. Schwartz, Bransford and Sears [2005] describe an optimal growth path: the optimal adaptability corridor. For each individual, that path may be different.

Because most of the students in the C-lab seem to have a particular eye on the tangible result — their own innovation — they were initially not quite aware that in participating in the C-lab they go through a personal professional development process at the same time. This was one of the reasons we decided to develop a parallel course on Personal Professional Development. We consider it is increasingly important that (future) professionals imagine what kind of practitioners they wish to be, to what extent their learning experiences contribute to these future roles and what they still have to learn. In the Professional

Development course three concepts are central: professional identity, autonomy and adaptive expertise. Students explore these concepts, use them to reflect on their own performance in a particular context, and invite practitioners to discuss the meaning of those concepts in practice. Within the course we facilitate students in meeting science communication practitioners and to discuss their experiences in taking potential hurdles. One of the issues in the discussions is how to avoid becoming a frustrated novice, a practitioner who focuses on change and innovation and can't find the balance between routine and innovation. In this way we provide science communication students with knowledge and skills to develop a range of cognitive, motivational and personality-related characteristics [Hatano and Inagaki, 1986].

Both the Personal Professional Development course and the C-lab are objects of research. In the C-lab, we monitor all students by means of surveys, interviews and analysis of their logbooks to see to what extent they gain adaptive expertise. Most science communication students and practitioners involved have stated they liked the mutual exchange of insights and experiences. Overall, they found it worthwhile to focus on their personal professional development. Most students who participated in both courses claimed they knew better how to deal with uncertainty in science communication processes as a result of taking those courses, and would like to put their innovation skills into practice in the first three years of their career.

We have chosen to develop the networked approach because complex science communication problems and becoming adaptive practitioners demand collaboration between various disciplines and design processes, bringing up tensions, paradoxes and ambiguities as daily reality. The approach may work well in our educational context for several reasons. The students have a background in various technical education programmes, ranging from Industrial Design to Applied Mathematics, and can therefore learn a lot from each other when they work together in multidisciplinary teams. Moreover, many of the students have already gained some experience with designing in their technical Bachelor programme and are open to apply design methods to complex science communication problems. Finally, students value the equal and direct contact with project-commissioners in their collaboration. These circumstances offer us a great opportunity to develop and test design methods for science communication and to perform research into adaptive expertise. These methods may need to be adapted for application in other universities, but we are convinced that the networked approach and similar methods can be used in any university.

Science communication as a field-lab

This local example of how diversity works out in a field lab, in which various perspectives and disciplinary backgrounds work together in designing future solutions, might also represent a contribution to the discussion in the international science communication communities on what the field is and how it is developing. By following deterministic AND holistic approaches and critically discussing the results in a field lab called science communication, we continuously practice what we preach and hopefully deconstruct our own deficit instead of insisting on solely describing that field, theoretically and practically. We might aim to make science communication a networked field of adaptive researchers and practitioners that articulates the dynamic intermediate space between science, technology and society.

References

Broks, P. (2017). 'Science communication: process, power and politics'. *JCOM* 16 (04), C02. URL: https://jcom.sissa.it/archive/16/04/JCOM_1604_2017_C01/JCOM_1604_2017_C02.

Davies, S. R. and Horst, M. (2016). Science Communication. Culture, identity and citizenship. U.K.: Palgrave Macmillan. DOI: 10.1057/978-1-137-50366-4.

Hatano, G. and Inagaki, K. (1986). 'Two courses of expertise, in H. Stevenson'. In: Children development and education in Japan. Ed. by H. Azuma and K. Hakuta. New York, U.S.A.: Freeman, pp. 262–272.

Hong, C.-P. and Wehrmann, C. (2010). 'Do science communication programs equip students to become professionals? A comparison of 20 university programs worldwide'. Proceedings to 11th International Conference on Public Communication of Science and Technology (PCST), New Delhi, India, December 2010. In: URL: https://www.pcst.co/archive/paper/761.

Schwartz, D. L., Bransford, J. D. and Sears, D. (2005). 'Efficiency and innovation in transfer'. In: Transfer of Learning from a modern multidisciplinary perspective. Ed. by J. P. Mestre. Information Age Publishing, U.S.A., pp. 1–51.

Trench, B. and Bucchi, M. (2010). 'Science communication, an emerging discipline'. *JCOM* 09 (03), C03. URL: http://jcom.sissa.it/archive/09/03/Jcom0903%282010%29C01/Jcom0903%282010%29C03.

van der Sanden, M., Evans, W. and Priest, S. (2017). 'Issue Introduction'. *Science Communication* 39 (2), pp. 139–141. DOI: 10.1177/1075547017700625.

van der Sanden, M. C. A. and Flipse, S. M. (2015). 'A cybernetic dream: how a crisis in social sciences leads us to a Communication for Innovation-Laboratory'. *JCOM* 14 (01), Y01. URL: https://jcom.sissa.it/archive/14/01/JCOM_1401_2015_Y01.

van der Sanden, M. C. A., Weitkamp, E., Autzen, C. and Trench, B. (2016). 'PhD-research as a marker of science communications development'. In: *PCST 2016 Public Communication of Science and Technology, Istambul, Turkey, 26–29 April 2016*. URL: http://eprints.uwe.ac.uk/28813.

Wehrmann, C. and Henze-Rietveld, I. (2016). 'A Pedagogy to Educate Novices to Professionalize: On the Crossroad of Science and Technology Education and Communication'. In: *Science and Technology Education and Communication*. Ed. by M. C. A. van der Sanden and M. J. de Vries, pp. 107–128. DOI: 10.1007/978-94-6300-738-2_7.

Authors

Caroline Wehrmann and Maarten van der Sanden were the founders of the two-year MSc programme in Science Communication at Delft University Netherlands. Caroline is assistant professor and performs research into adaptive expertise. She developed a model of communication professional profiles, in collaboration with the association of communication practitioners in Holland, and a benchmark on how to staff a communication department. Both are currently used and discussed amongst professionals. E-mail: C.Wehrmann@tudelft.nl.

Maarten van der Sanden and Caroline Wehrmann were the founders of the two-year MSc programme in Science Communication at Delft University Netherlands. Maarten is associate professor and developed a social designing method for science communication. His research focuses on the social design of collaborative processes and decision support systems to make decisions upon these collaborations. E-mail: M.C.A.vanderSanden@tudelft.nl.

How to cite Wehrmann, C. and van der Sanden, C. A. (2017). 'Universities as living labs for science communication'. *JCOM* 16 (05), C03.

ISSN 1824-2049. Published by SISSA Medialab. jcom.sissa.it